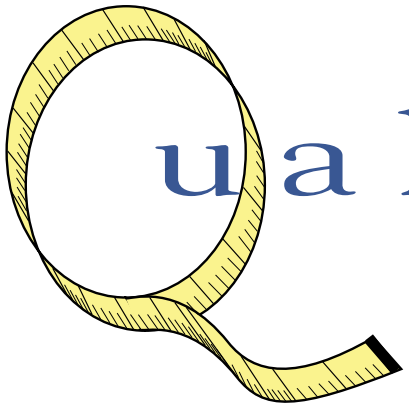

Health Care
Quality
Performance
Measurement

Patient Outcomes and Nurse Sensitive Indicators: A National Overview

February 2002

Rhode Island
Department of Health

Health Care Quality
Steering Committee

Number 12

NURSE SENSITIVE PATIENT OUTCOMES

FINAL REPORT

Prepared for the Rhode Island Department of Health

Lauren L. Williams, EDM, RN

October 8, 2001

Contact Information:
13 Austin Lane, Little Compton, RI 02837
e-mail: lwilliam@postoffice.providence.edu

TABLE OF CONTENTS

NURSE SENSITIVE PATIENT OUTCOME RESEARCH
Executive Summary

The Rhode Island General Assembly (July 20, 2000) called for quality care initiatives involving the identification, collection, and measure of performance indicators. This report specifically addresses the mandate: "(7) consideration of nursing sensitive performance measures to be reported on." The charge for this project involved 1) the identification of patient outcomes potentially sensitive to nursing care; 2) the selection of those indicators found to have an empirically supported relationship to nurse staffing; and 3) the determination of data availability allowing for possible monitoring. The project commenced in February, 2001 and concluded October 1, 2001.

Definition The American Nurses Association (ANA) defines nursing-sensitive quality indicators as "those indicators that capture care or its outcomes most affected by nursing care." Examples of adverse outcomes commonly include pressure ulcers, respiratory complications, and urinary tract infections. Each of these outcomes is believed to be affected by preventative or interventional care by nurses. Broadening the concept of patient outcomes, this project also considers outcomes associated with adverse patient events (i.e., medication administration errors, patient falls). Also considered were outcomes associated with a patient's expectations (patient satisfaction) rather than a clinician's perspective.

Project Implementation The project began with an extensive review of the literature narrowed by the charge to focus on the empirical evidence to date of the relationship between adverse patient outcomes and nurse staffing. Discussions with experts in the field and a review of conference reports on the subject ensued.

The review suggests that work in this area is relatively new having surged after 1996 when the Institute of Medicine (IOM) noted a "serous paucity of recent research" concerning the relationship between adverse patient outcomes and nursing care. The quality of studies of work before this time is highly variable. Frequently, results concerning the relationship between these variables and nurse staffing were inconclusive. Recent methodological advances in health services research have led to improvements in the quality of studies, although significant limitations associated with data collection continue to exist. As such, the body of knowledge in this area of inquiry is in its early development.

Categories of Studies to Date Studies to date may be grouped into three categories:

- Changes in patient care delivery models and nurse staffing (1960s-1970s). Prominent studies of this type reveal conflicting results concerning the effect changes in the organization of nursing care had on quality, patient satisfaction, and cost.
- Patient mortality and nurse staffing (1980s-mid1990s). Findings among studies were inconsistent, shifting attention to more specific adverse patient outcomes.
- Specific adverse patient outcomes and nurse staffing. Early work suggests there are outcomes empirically linked to nurse staffing, although they are limited in number at this time. The focus of this project is a meta-review of these studies.

Process for Selecting Patient Outcomes Patient outcomes and their relationship to nurse staffing were identified from the empirical studies in the nursing, medical, or health services

literature to date. Findings were examined within and between studies. The selection of outcomes is a result of the empirical evidence to date. The selection process is itself limited by 1) the fact that this field of study is relatively new; 2) the units of analysis vary (patient care level analysis and hospital level analysis); and 3) the quality research conducted is variable. There exists no definitive, quantitatively agreed upon understanding of outcomes that are potentially sensitive to nursing care at this time.

Findings Outcomes potentially sensitive to nursing that may be included as measures given their consistency across studies are pressure ulcers, respiratory complications (pneumonia), and urinary tract infections. In addition, length of stay has consistently demonstrated an inverse relationship with nurse staffing. Other outcomes require further research in order to make sense of the mixed results to date: gastrointestinal bleeding, thrombosis, wound infection, and cardiopulmonary arrest. Numerous 'exploratory variables' are being added to studies with the potential of expanding the range outcomes found to be sensitive to nursing in the future.

Additional Considerations However important, medication administration errors and patients falls are not among recommended variables for measurement at this time. Reasons they are not among the suggested measures are: 1) the lack of empirical evidence (a criteria established for recommendations for this project) that links nurse staffing and these adverse outcomes and 2) the difficulty obtaining complete sources of data.

Patient satisfaction literature consistently suggests high patient satisfaction with nursing care. We learn via satisfaction research about those nursing process indicators patients value (nursing interventions such as communication, teaching, safety, and physical comfort); however, we learn little about their relationship to a patient's clinical health outcome. Research concerning the relationship between patient satisfaction and health outcomes as well as research exploring the link between satisfaction and nurse staffing is lacking.

Conclusion Despite continued data source difficulties, a meta-review of the literature indicates there are adverse patient outcomes sensitive to nursing care now beginning to be identified. A few recent high quality studies suggest urinary tract infections, pneumonia, and skin ulceration may have a significant, negative relationship to nurse staffing. In addition, findings are revealing an inverse relationship between nurse staffing and measures of a patient's hospital length of stay. Attempts to measure adverse patient events such as medication administration errors and patient falls are hindered by a lack of quality data. Patient satisfaction surveys, such as the *Report of Patient Satisfaction with Hospital Care in Rhode Island,* offer valuable information about the extent to which expectations regarding nursing care are being met. Yet to be explored is the relationship between satisfaction with nursing care and outcomes.

Recommendation At this time, there is no definitive agreement on those outcomes believed to be nursing sensitive that is quantitatively supported across multi-institutional investigations. Research now underway promises greater insight and confidence in the use of nursing sensitive outcomes as performance measures. Wider agreement among the nursing and medical community concerning these measures seems warranted before they are

used as performance measures to be reported on; hence, continued monitoring of unfolding research is recommended.

NURSE SENSITIVE PATIENT OUTCOME RESEARCH

Final Report

Overview

This report summarizes the research to date addressing patient outcomes deemed potentially sensitive to nursing care. The report includes a discussion of the process used herein to select indicators, the rationale for their inclusion, and the availability of data for tracking in Rhode Island hospitals. The purpose of the report is to identify empirically supported indicators of quality care in hospitals linked to nurse staffing and determine data sources for possible monitoring.

Results suggest that although considerable work is in progress, there is much yet to be learned. Studies to date are limited in agreement concerning the nature of patient outcomes consistently and strongly related to nurse staffing. Across studies three patient outcomes demonstrate a well-supported inverse relationship to nurse staffing: pressure ulcers, respiratory complications (in particular pneumonia), and urinary tract infections. Also, a patient's length of stay in the hospital is consistently found to have a negative relationship to the availability of nursing staff. Numerous other patient outcome indicators have been studied, but a meta-review finds mixed results across studies or early, promising findings that warrant further study.

Background

The law entitled "Health Care Quality Program" enacted July 20, 2000 by the Rhode Island General Assembly calls for a number of initiatives associated with the identification, collection, and measure of performance indicators that contribute to quality care. This report addresses the specific mandate: "(7) consideration of nursing sensitive performance measures to be reported on." Accordingly, the primary objectives for this study involve 1) the identification of patient outcomes potentially sensitive to nursing care; 2) the selection of those indicators found to have an empirically supported relationship to nurse staffing; and 3) the determination of data availability allowing for possible monitoring. In addition, this report contributes to the additional mandate that the Department of Health consider "the relationship between human resources and quality, beginning with measurement and reporting for nursing staff."

The American Nurses Association (ANA) defines nursing-sensitive quality indicators as "those indicators that capture care or its outcomes most affected by nursing care." Examples of adverse outcomes commonly regarded as nurse-sensitive includes for example, pressure ulcers, respiratory complications, and urinary tract infections among others. Each of these outcomes are believed to be affected by preventative or interventional care by nurses providing direct patient care. Broadening the concept of patient outcomes, one may also consider outcomes associated with adverse patient events (i.e., medication administration errors, patient falls). Beyond those outcomes measured from a clinician's perspective are indicators assessed from a patient's perspective (i.e., patient satisfaction).

Review of Nurse Sensitive Patient Outcome Research

Method

This report is the result of a comprehensive review of the empirical literature concerning the relationship between nurse staffing and indicators of care considered potentially sensitive to nursing care in the hospital setting. A computer aided literature search, it included peer review journal in the nursing, medical, and healthcare administrative/policy literature with particular attention given to recent empirical work. In addition, several experts in this field of study were contacted for advice about work in progress.

Review Results

There exists a limited, but growing, body of research seeking to understand the relationship between patient outcomes and nurse staffing. Interest sparked in 1996, when Congress, through the Department of Health and Human Services Administration, charged the Institute of Medicine (IOM) to report on the relationship between nurse staffing in hospitals/nursing homes and quality. Their report noted a "serious paucity of recent research" in this regard and urged the development of a research agenda that might guide policy makers.

Growing competitiveness in the healthcare system and ominous trends in the nursing workforce are motivating researchers to seek definitive answers to questions about the relationship between nurse staffing and patient outcomes. Despite the recent surge of studies since the IOM recommendation, this report reflects the limitations of a body of knowledge that remains in its early development.

Researchers have examined the relationship of nurse staffing and 1) changes in patient care delivery models; 2) mortality; and 3) adverse patient outcomes other than mortality. A summary of the meta-review of findings indicates the following:

- *Changes in patient care delivery models*

Early nurse staffing studies were interested in the effect of changes in the organization of nursing care on hospitalized patient. During the period from 1960 and into the early 1970s, nurses moved away from the traditional organization of care, that is the individual assignment of functions (the division of labor according to tasks such as medications, dressings, treatments, etc.) toward team nursing (a team of nursing personnel composed of RNs, LPNs, and aides assigned to a group of patients). In the mid to late-1970s and 1980s, nurse staffing was again influenced by a change in delivery models from team nursing to primary nursing (RNs assumed accountability for managing a patient's stay throughout their hospitalization). Prominent studies of this period reveal conflicting

results concerning the effect these transitions had on care quality, patient satisfaction, and cost.

More recently, researchers sought to understand the impact of changing staff mix when unlicensed nursing personnel were added as a cost-reduction strategy. The staff mix of nursing personnel refers to the proportion of RNs, LPNs, or aides to the total staff. Staff mix received considerable attention in structural studies as hospitals added unlicensed assistive personnel (UAPs) as a means to reduce cost. Although not directly related to a discussion of nursing sensitive patient outcomes, yet important to quality, Pierce (1997) reports that studies investigating the relationship between the use of UAPs and cost and quality have conflicting results. Two studies report cost savings while six did not (p.62).

Studies addressing changes in patient care delivery models and the use of UAPs are inconclusive about their effect on care as demonstrated by their mixed results. As this work continues, attention is also being given to outcomes research.

- *Patient mortality and nurse staffing*

As large national databases became available and advances made in refining measures to adjust for a patient's severity of illness, researchers began to consider the relationship between registered nurse (RN) staffing and risk adjusted mortality. Reviewed for this project, the studies are inconclusive concerning the relationship. The inconsistencies are widely, although not uniformly acknowledged in the literature.

Several well regarded studies reveal a statistically significant and negative relationship between the level of nurse staffing and mortality (Aiken, Smith, and Lake, 1994; Scott, Forrest, and Brown, 1976; Silber, Rosenbaum, & Ross, 1995). For example, Aiken and colleagues (1994) studied mortality rates in magnet hospitals, that is hospitals with a good reputation for the practice of nursing based on observational criteria established by the Academy of Nursing in the early 1980s. Despite several limitations acknowledged by the researchers in this early study, there was evidence to conclude that there were from 0.9 to 9.4 fewer deaths per 1,000 Medicare discharges in magnet hospitals. A study by Czaplinski an Diers, 1998 found a significant and negative relationship between the areas of nurse specialization and mortality in select DRGs (Czaplinski and Diers, 1998). A prominently reported study by Knaus, Draper, and Wagner (1986) found the most significant variable associated with mortality in intensive care units was nurse/physician communication.

In contrast to these studies, several others found no significant relationship between nurse staffing and mortality (Al-Haider & Wan, 1991; Silber, Williams, Krakauer, & Schwartz, 1992; Shortell & Hughes, 1988).

Mitchell and Shortell (1997) note that although inconsistent results are found in their review of mortality studies, some support does exist that suggests nursing surveillance, quality of the working environment, and the quality of interaction with other professionals is associated with hospitals that have lower mortality rates and a lower number of adverse patient events (abstract). In sum, the empirical evidence as it relates to nurse staffing and patient mortality is not conclusive. Increasingly, researchers suggest that attention shift from mortality data to specific adverse patient outcomes that are "more

sensitive to discrete or subtle changes in either structure of process [of nursing care]"(Pierce, 1997, p.64).

The inconsistency of findings across studies raises questions about the use of mortality, however important, as an indicator of nursing care quality. Pierce (1997) writes, "mortality varies with major parameters and is not sensitive to discrete or subtle changes in either structure or process [of nursing care]" (p.64). It is a long-term indicator that, as a result, is influenced by a multitude of factors. These researchers conclude that adverse events may be more sensitive to changes in organizational structure and process than mortality.

In summary, the empirical evidence as it relates to nurse staffing and patient mortality are not conclusive and some researchers suggest attention shift from an examination of mortality to more specific adverse patient outcomes. The growing interest in nurse-sensitive patient outcome research reflects this shift to adverse iatrogenic patient complications.

- *Adverse patient outcomes (other than mortality)*

The identification of specific patient outcomes sensitive to nursing is a work in progress; that is, both complications established in the literature and others considered exploratory are under study. These adverse patient outcomes are those most directly related to Rhode Island's legislative mandate and the basis for this project.

The American Nurses Association (ANA) defines nursing-sensitive quality indicators as "those indicators that capture care or its outcomes most affected by nursing care." Examples of adverse outcomes under investigation includes for example, pressure ulcers, pulmonary complications, and urinary tract infections among others. Each of these outcomes are believed to be affected by preventative or interventional care by nurses providing direct patient care. To date, the outcomes chosen as study variables have to two sources: 1) those outcomes recognized in the nursing/medical/health services literature as linked to nursing care, and 2) clinical indicators included in the Healthcare Cost and Utilization Project (HCUP) databases.

For hospital level analysis, sources of data include hospital cost reports, state discharge databases, and the AHA annual survey of hospitals. The HCUP databases (the Nationwide Inpatient Sample and the State Inpatient Database) are sometimes employed. HCFA's Medicare Provider Analysis and Review (MEDPAR), a federal database containing Medicare recipient data, has recently been used as a source of patient outcome data. Studies conducted at the patient unit level of analysis collect data using hospital information systems, chart reviews, and departmental level data (i.e., quality data, risk management data). Several new sources of nurse staffing data are currently under development. They include the California Nursing Outcomes Coalition (CalNOC) database and the ANA sponsored National Data Center for Nursing Quality Indicators (NDNQI).

Researchers are cautious about any apparent suggestion that an adverse outcome is preventable through nursing intervention. Rather, as noted by Litchtig et al (1999), "only that there is a relationship between proper nursing care and the rate of these outcomes"

(p.27). Researchers are averse to implying cause-effect relationships given the multidisciplinary context in which care is provided. Studies commonly note that patient care occurs in a multidisciplinary context and is "not the exclusive domain of nursing" (p.25).

This report next turns to the meta-review of studies specific to adverse patient outcomes and their relationship to nurse staffing.

Review of Studies Addressing Adverse Patient Outcomes Potentially Sensitive to Nursing

Limitations Commonly Acknowledged in Studies

The studies reviewed for this report note numerous limitations. It is important that in the process of identifying nursing sensitive performance measures for future reporting, one is mindful of the complexity of this research and the trade-offs made to overcome obstacles in the conduct of this research.

- The incomplete reporting of secondary diagnoses, differences in the selection of diagnoses for inclusion by coders, and the lack of consistency among states in recording pre-existing conditions (Needleman, 2001). Within institutions, there is likely inconsistencies or inaccurate coding (Kovner et al, 1998).
- Conditions attributed to the patient such as co-morbidities of a history of compromising health behaviors may go unrecognized. Patient characteristics influence outcomes both favorably and adversely (Silber et al, 1995b).
- Discharge data is recorded primarily for billing purposes, thus conditions that do not affect payment may not be reflected (Needleman, 2001).
- The difficulty of isolating nursing's contribution to an outcome from other disciplines (Maas, Johnson, & Moorehead, 1996).
- The lack of generalizability of studies conducted at the patient care unit level and the lack of specificity that results from the use of data aggregated at the hospital level. Blegen (1998) notes that hospital case-mix adjustments neglect differences at the patient care unit level where the impact of nursing care is most direct. Patient care unit studies generally involve small samples, special data collection efforts, and extensive coordination in multi-institutional studies.
- Positive patient outcomes are rarely addressed due to the nature of retrievable data limiting the number of outcomes that can be measured (Needleman et al, 2001).
- Reliable data sources for the use of unlicensed assistive personnel are not available.

Process for Selecting Patient Outcomes and Indicators for this Project

First, patient outcomes and indicators were identified from the empirical studies in the nursing, medical, or health services literature to date. Each outcome/indicated was examined in light of other studies. In what studies was the outcome/indicator a variable in relation to nurse staffing? What were the findings in 1) each study and 2) across studies?

The selection of these outcomes/indicators is a result of the empirical evidence to date. The selection process is itself limited by 1) the fact that this field of study is relatively new, 2) the units of analysis vary (patient care level analysis and hospital level analysis), and 3) the quality research conducted is variable. There exists no definitive, quantitatively agreed upon understanding of outcomes that are potentially sensitive to nursing care. However, there are select outcomes reaching wider agreement as studies build and findings are replicated.

Finally, in accordance with legislative intent and the charge given for this project, indicators for which there is quantitatively supportive data and considerable agreement across studies regarding a relationship with nurse staffing are identified. It is on this basis that three patient outcomes and one indicator are the recommended measures for reporting should this project move forward. A patient's length of stay (LOS) has been linked to nurse staffing although it is not per se a patient outcome and thus referred to here as an indicator. At the same time, an additional five outcomes were seriously considered for recommendation as potential measures, but were found to have either mixed results across studies or were only recently identified in a single study.

Findings

The meta-review of studies conducted for this project resulted in two categories of indicators. A first category includes those indicators where the studies agree as to the direction of the relationship between the indicator and nurse staffing. Those indicators included in category one are described below with the justification for inclusion, notable studies supporting their inclusion, and current data sources should a decision to measure this indicator be made. Category two indicators include the rationale for considering the indicator's relationship to nurse staffing as being inconclusive at this time.

Category 1: Indicators where studies are in agreement

1. Patient Outcome Potentially Sensitive to Nursing: Urinary Tract Infections (UTI)

Rationale for inclusion: Urinary tract infections is an outcome well documented as having a negative, statistically significant relationship to nurse staffing.

Sources of data currently available: Needleman et al, 2001; ANA 2000; Kovner et al, 1998; Flood et al, 1998; Lichtig et al, 1999

Options for data collection: Patient discharge abstracts

2. Patient Outcome Potentially Sensitive to Nursing: Pressure ulcers (decubiti)

Rationale for inclusion: Pressure ulcers are a serious adverse outcome affected by nursing care. Iezzoni and colleagues (1994) included decubiti among complications that are potentially preventable through changes in the process of care. Statistically significant and negative relationships with nurse staffing levels have been found in a number of studies.

Sources of data currently available: ANA 2000; Lichtig et al, 1999; Blegen et al, 1998.

Options for data collection: Patient discharge abstracts

3. Patient Outcome Potentially Sensitive to Nursing: Respiratory complications

Rationale for inclusion: Respiratory complications and in particular pneumonia have been found to be inversely associated with nurse staffing (ANA 2000; Kovner et al, 1998). More specifically, Needleman et al (2001) found pneumonia had a strong and consistent relationship with nurse staffing in medical patients, while the relationship was weak in surgical patients. Only Lichtig et al (1999) found mixed results in a pilot study using four data sets (two California, two New York). Despite Lichtig's mixed results, respiratory complications is included in category one based on the agreement found among high quality studies examining this indicator. Pneumonia after major surgery or an invasive procedure is among the HCUP quality indicators and included in Iezzoni et al's (1994) list of potentially avoidable complications.

Sources of data currently available: ANA 2000; Kovner et al, 1998; Needleman et al, 2001 (strong and consistent relationship for medical patients only).

Options for data collection: Patient discharge abstracts.

4. Indicator: Length of stay (LOS)

Rationale: Although not a patient outcome by definition, a patient's hospital length of stay (LOS) is an indicator included in nurse staffing studies. Lichtig et al (1999) found a statistically significant and negative relationship between a patient's LOS and both total nursing care hours and a higher skill mix of nurses. This finding was consistent across all four of their data sets. Needleman et al (2001) found a strong and consistent relationship among medical patients, but not in surgical patients.

Data source: Lichtig et al (1999); Needleman et al (2001)

Options for collection: Patient discharge abstract.

Category 2: Indicators where convergence of results across studies does not occur

1. Gastrointestinal bleeding

Gastrointestinal bleeding is occasionally found to have a negative relationship with nurse staffing (Flood et al, 1988) and more specifically, upper gastrointestinal bleeding in medical patients (Needleman et al, 2001). Consistent with Needleman and colleagues, Kovner et al (1998) found no relationship between staffing and gastrointestinal bleeding in their study of post-operative patients. Differently, Iezzoni et al (1994) has included postoperative gastrointestinal hemorrhage or ulceration among complication that might be preventable with changes in the process of care.

2. Thrombosis

Thrombosis has been studied as a possible adverse outcome associated with nurse staffing. Findings are mixed. Kovner et al (1998) found this HCUP quality indicator to be inversely related to nurse staffing. Conversely, the ANA (2000) and Needleman et al (2001) found either no relationship or inconsistent results.

3. Wound infection

Studies that have examined wound infections in relation to nurse staffing are inconclusive as to their sensitivity to nursing care. The ANA (2000) study found a significant and inverse relationship to both the total number of nursing care hours and the percent of registered nurses. Mixed results were found by Lichtig et al (1999) where two California data sets found an inverse relationship with nurse staffing, while New York data did not. Needleman et al (2001) found no such relationship in their sample of surgical patients.

4. Failure to rescue

"Failure to rescue" is a relatively new outcome measure that reflects the rate of death following complications (Sochalski & Aiken, 1999). A failure to rescue variable was used by Silber et al (1992) to analyze a relationship of anesthesia board-certification and the presence of house staff (p.626), an interest akin to the relationship in question here. Using this new indicator, Needleman and colleagues (2001) found a strong and consistent negative relationship between nurse staffing and failure to rescue in surgical patients (the relationship in medical patients was inconsistent). Further research using this indicator seems warranted.

5. Shock/cardiopulmonary arrest

Shock and/or cardiopulmonary arrest is sometimes explored as a nurse-sensitive quality indicator. Iezzoni et al (1994) included this outcome among the complications suggested for screening. Only Needleman et al (2001) found in his medical sample a strong inverse relationship between shock and nurse staffing. Kovner and Gergen (1998) found no relationship related to acute myocardial infarction and nurse staffing.

In sum, outcomes potentially sensitive to nursing that may be included as measures with confidence are pressure ulcers, respiratory complications (pneumonia), and urinary tract infections. In addition, length of stay has consistently demonstrated an inverse relationship with nurse staffing. Other outcomes require further research in order to make sense of the mixed results to date: gastrointestinal bleeding, thrombosis, wound infection, and cardiopulmonary arrest. In the meantime, numerous 'exploratory variables' are being added to studies with the potential of expanding the range outcomes found to be sensitive to nursing in the future.

Additional Considerations: Adverse Patient Events and Patient Satisfaction

Adverse Events

Recent concerns about the number of adverse events that occur in hospitals raises concerns about a possible relationship between problems such as medication errors or patient falls and nurse staffing.

- Medication Administration Errors

  Medication administration errors and the accidental injury of patients are not uncommon in hospitals as widely acknowledged since the release of the IOM report, *To Err is Human* (2000). The IOM contends "deaths due to medical errors exceed the number attributed to the 8th leading cause of death; more than those who die from motor vehicle accidents, breast cancer, or AIDS" (p.1). Buerhause et al (2000) reviewed the medication administration literature and estimated the frequency and cost of these adverse events. They note work done by Leape et al (1991, 1995) and others that suggests 19 percent of injuries in hospitalized patients are attributed to adverse drug events and 38 percent of these are associated with nursing care.

  Little research has been done to understand the possibility of a link between medication errors and nurse staffing. One report on the matter offered curious results. Blegan and Vaughan (1998) found a nonlinear relationship between RN staffing and medication errors. As expected, the rate of medication administration errors declined as the proportion of Registered Nurses increased from 50-85 percent. Surprisingly, this relationship turned positive when the number of errors rose as the Registered Nurse mix increased from 85-100 percent. This non-linear relationship is yet to be explained.

  The study of the relationship of nursing staff to medication error requires greater attention. As was found in other studies described herein, an inability to gather reliable data efficiently is a barrier to quality research. Medication errors are not routinely reported outside the institution except in the most egregious of cases when mandated. Further, medication errors are notoriously underreported within institutions. These data collection problems along with a lack of supporting research in this area would cause medication errors to be a difficult measure to implement at this time.

- Patient Falls

In addition to medication error, Buerhause et al's review of patient fall literature revealed that falls are the single largest adverse incident reported in hospitals. It is estimated that 20 to 70 percent are preventable (p.8). In an effort to link nurse staffing and patient occurrences such as these, Blegan et al (1998) reviewed studies concerning the relationship between nurse staffing and patient falls (n=8 studies). Results were highly inconsistent.

As the California Nursing Outcomes Coalition (CalNOC, 2000) recently cautioned, patient falls cannot always be predicted or prevented in hospitals. CalNoc's state data for four quarters during 1998 and 1999 revealed the occurrence of 1 fall per 1,000 patient days in critical care units and 3.7 falls in medical surgical units.

However important, medication administration errors and patients falls are not among recommended variables for measurement at this time. Reasons they are not among the suggested measures are: 1) the lack of empirical evidence (a criteria established for recommendations for this project) that links nurse staffing and these adverse outcomes and 2) the difficulty obtaining complete sources of data.

Patient Satisfaction

In concept, patient outcomes research goes beyond the measure of physiologic changes associated with clinical processes and interventions to include the patient's satisfaction with care. As defined by Gerszten (1998), outcomes research "emphasizes the measurement of patient health outcomes, including the patient's symptoms, functional status, quality of life, satisfaction with treatment, and health care costs" (abstract). Patient satisfaction surveys measure the patient's or the caregiver's opinion of the care received from nurses. In other words, patient satisfaction reflects ones' perception that the "expected experience is being met or has been met at an adequate or superior level of quality" (Shullanberger, 2000). The American Nurses Association (1995) noted that "researchers have found that satisfaction measures are influenced by factors that may not truly reflect quality of care (e.g., age, gender, and health status)." In other words, there exists a research need to link patient satisfaction to patient outcomes.

Dimensions of nursing care commonly assessed in patient survey instruments include technical-professional capability, trust relationships, and educational relationships (ANA, 1995). As noted by the ANA and continuing today, the relationship between the adequacy of nurse staffing and overall patient satisfaction has not been directly studied (p.44). Likewise, Lamb-Havard (1997) calls for research to demonstrate the relationship between direct nursing interventions and outcomes that include satisfaction with care that reflect patient outcomes as differentiated from institutional outcomes (i.e., image).

Pierce (1997) noted that patient satisfaction literature consistently suggests high patient satisfaction with nursing care. She attributes the result to the patient's rationalization of their experience as a means to cope with the stress associated with their vulnerability during hospitalization. Ratings are thus considered by Pierce to be

"artificially inflated" (p.66). Patients rate their satisfaction primarily on how the nurse treated them, rather than their resulting health outcome. As evidence, Pierce notes a small, one setting study (n=91 cases) by Valentine (1991) where data did not support a link between patient satisfaction and either length of stay or postoperative outcomes. Valentine, however, did find that aspects of nursing care such as communication, teaching, and physical care are related to satisfaction and future hospital choice. Pierce concludes that patient satisfaction "as an outcome measure [is] more closely aligned with marketing than with valid health benefit claims" (Pierce, 1997, p.68). Importantly, we learn via satisfaction research about those nursing process indicators (nursing interventions such as communication, teaching, safety, and physical comfort) important to patients, but we learn little about relationship to a patient's clinical health outcome.

A Report of Patient Satisfaction with Hospital Care in Rhode Island reflects several of these nursing process indicators. Communication and the development of a trusting professional relationship is evident in the item, "Did you feel comfortable sharing your personal concerns with the nursing staff?" Expectations regarding teaching interventions are found in responses to the query, "When you left the hospital, did you have a better understanding of your illness than when you entered?" However, this question also reflects the multidisciplinary nature of patient care services and the difficulty culling out the contributions of nursing alone. The nurses' role in addressing patient safety expectations is found in the item, "When you used your call button, were you answered promptly?" Lastly, the extent to which nurses meet physical comfort needs is evident, for example, in the question, "Were you satisfied with how well your pain was controlled?" Again, this question will reflect care rendered by more than the nurse since the response is in part dependent on the ordering physician. In short, the *Report of Patient Satisfaction with Hospital Care in Rhode Island* offers the opportunity to measure satisfaction with the care received; however, the use of select indicators will be difficult given the fact that nursing care is embedded in a complex and multidisciplinary context.

Conclusion

The relationship between nurse staffing and adverse patient outcomes is not yet fully understood. Since the Institute of Medicine (1996) expressed its concern about a lack of empirical study to guide decision-making, research efforts have intensified. Much of this work is currently in progress. Federal funding is supporting numerous projects slated for completion in the next several years (Table 2).

Meanwhile, researchers struggle to identify those patient outcomes that may be nurse sensitive. Obstacles and limitations are imposed on research as a result of the need for quality data that can be obtained affordably and efficiently. Complexity abounds. For example, the need for researchers to compensate for a deficiencies in coding for pre-existing conditions, the absence of specificity in categorizing nursing personnel including nursing aides, and the need to use multiple administrative databases to address research questions.

Early studies examined nurse staffing and patient care quality as delivery models evolved. Those examining the association between nurse staffing and mortality then followed. In both cases, a meta view of these studies reveals results to be inconsistent offering limited insight into the relationship between nurse staffing and patient care quality. These mixed results led to a shift in attention to examining more specific adverse outcomes and nurse staffing.

Despite continued data source difficulties, a cumulative review of the literature does suggest there are adverse patient outcomes sensitive to nursing care are beginning to be identified. Those generally supported as being nurse sensitive include urinary tract infections, pressure ulcers, and respiratory complications (pneumonia). In addition, findings consistently reflect an inverse relationship between nurse staffing and measures of a patient's hospital length of stay. There is less agreement among studies that consider the relationship between staffing and gastrointestinal bleeding, thrombosis, wound infections, and shock/cardiopulmonary arrest. Future research may address these inclusive findings while exploratory variables (i.e., failure to rescue) may add to the list.

The relationship between nurse staffing and adverse patient events, in particular medication error and patient falls requires further inquiry. These adverse events have potentially serious consequences for patients and their families. To explore possible links to nurse staffing, sizable data collection problems need to be addressed and barriers to reporting overcome. Quality data may emerge in the near future thus facilitating research as our national perspective shifts from placing blame to creating safe practice environments where identifying and learning from errors becomes a priority. In the meantime, data sources for these measures face the problem of incomplete reporting.

Patient satisfactions measures reflect consideration for the patient's point of view in addition to that of the clinician. Satisfaction surveys provide valuable information about the extent to which patient or family expectations are met. However, there exists little empirical evidence linking satisfaction measures with health outcomes.

Substantial research effort is currently underway to identify nurse sensitive patient outcomes and understand their relationship with nurse staffing. State efforts to measure and monitor nurse sensitive quality indicators will face many of the same challenges researchers have noted concerning clinical and administrative data collection.

Recommendations

Included in the charge for this project was the expectation that specific recommendations be made concerning the legislative mandate that "consideration of nursing sensitive performance measures be reported on." At this time, quality multi-institutional research identifying patient outcomes sensitive to nursing care is in its early stages. Numerous promising efforts are funded and in progress. Recent studies by the American Nurses Association (2000) and Needleman et al (2001) demonstrate substantial advancements in overcoming numerous barriers associated with data collection and analysis. In addition, efforts to develop databases specifically for the purpose of

understanding the relationship between nurse staffing and patient outcomes are underway (CalNOC and the NDNQI).

The identification of patient outcomes potentially sensitive to nursing care is a matter under considerable investigation. At this time, there is no definitive, quantitatively based agreement on nursing sensitive outcomes across studies. However, recent work suggests several outcomes are likely to have a significant, negative relationship to nurse staffing (i.e., urinary tract infections, pneumonia, skin ulceration) while many others are being explored.

In sum, continued monitoring of investigation results is recommended. Empirically supported knowledge about patient outcomes sensitive to nursing care is very limited, but growing. Research now underway promises greater insight into nurse sensitive patient outcomes and greater confidence in their use as performance measures. Wider agreement among the nursing and medical community concerning these measures seems warranted before they are used as performance measures to be reported on; hence, continued monitoring of unfolding research is recommended. As a consensus about findings builds, Rhode Island could choose to be among the first to use nursing sensitive outcomes as measures of quality performance.

REFERENCES

Aiken, L., Smith, H., & Lake, E. (1994). Lower Medicare mortality among a set of hospitals known for good nursing care. Medical Care,32(8), 771-787.

Al-Haider, A. & Wan, T. (1991). Modeling organizational determinants of hospital mortality. Health Services Research, 26(3), 303-323.

American Nurses Association. (2000). Nurse staffing and patient outcomes in the inpatient hospital setting. Washington, D.C.: American Nurses Publishing.

Blegen, M., Goode, C., & Reed, L. (1998). Nurse staffing and patient outcomes. Nursing Research, 47(1), 43-50.

Blegen, M. & Vaughan, T. (1998). A multisite study of nurse staffing and patient occurrences. Nursing Economic$, 16(4), 196-203.

Blegen, M. (2001). Proceedings of the American Organization of Nurse Executives Annual Meeting: Evidence-Based Staffing: It Is Possible. Los Angeles, CA., March 16, 2001.

Buerhouse, P., & Needleman, J. (2000). Policy implications of research on nurse staffing and quality of patient care. Policy, Politics, & Nursing Practice, 1(1), 5-15.

Buerhause, P., & Staiger, D. (1999). Trouble in the nurse labor market? Recent trends and future outlook. Health Affairs, 18(1), 214-222.

California Nursing Outcomes Coalition. (2000). A statewide nursing outcomes database: Linking patient outcomes to hospital nursing care. First summary report of key findings, 1998-1999 data.

Czaplinski, C. & Diers, D. (1998). The effect of staff nursing on length off stay and mortality. Medical Care, 36(12), 1626-1638.

Daly, J., Maas, M., Johnson, M. (1997). Nursing outcomes classification, An essential element in data sets for nursing and health care effectiveness. Computers in Nursing, 15(2), S82-S86.

Flood, S. & Diers, D. (1988). Nurse staffing, patient outcome and cost. Nursing Management, 19(5), 34-43.

Gerszten, P. (1998). Outcomes research: a review. Neurosurgery, 43(5), 1146-56.

Kohn, L., Corrigan, j., & Donaldson, M., Eds. 2000. To err is human: Building a safer health system. Washington: National Academy Press.

Kovner, C. & Gergen, P. (1998). Nurse staffing levels and adverse events following surgery in U.S. Hospitals. Image: Journal of Nursing Scholarship, 30(4), 315-321.

Knaus, W., Draper, E., Wagner, D., et al. (1986). An evaluation of outcomes from intensive care in major medical centers. Annals of Internal Medicine, 104, 410.

Lamb-Havard, J. (1997). Nurses at the bedside: Influencing outcomes. Nursing Clinics of North America, 32(3), 579-87.

Leape, L. Bates, D., Cullen, D., Cooper, J., Demonaco, H., Galivan, T., Hallisey, R. Ives, J., Laired, N. Laffel, G. Nemaskal, R., Petersen, L., Porter, K., Servi, D., Shea, B. Small, Sweitzer, B., Tompson, T., & Fliet, M. (1995). Systems analysis of adverse drug events. JAMA, 274, 35-43.

Leape, L., Brennan, T., Laird, N., Lawthers, A. Localio, A., Barnes, B., Hevert, L., Newhouse, J., Weiler, P., & Hiatt, H. (1991). The nature of adverse events in hospitalized patients. New England Journal of Medicine, 324, 377-384.

Lichtig, L., Knauf, R., Mullholland, D.K. (1999). Some impacts of nursing on acute care hospital outcomes. JONA, 29(2), 25-33.

Maas, M., Johnson, M., & Moorehead, S. (1996). Classifying nursing-sensitive patient outcomes. Image: Journal of Nursing Scholarship, 28(4), 295-301.

Mitchell, P. & Shortell, S. (1997). Adverse outcomes and variations in organization of care delivery. Medical Care, 35, (11 Supplement), 19-32.

Needleman, J., Buerhaus, P., Mattke, S., Stewart, M., & Zelevinsky, K. (2001). Nurse staffing and patient outcomes in hospitals. Final Report, Boston: Harvard School of Public Health. Prepared for the US Department of Health and Human Services Administration under contract no. 230-99-0021.

Pierce, S. (1997). Nurse-sensitive health care outcomes in acute care settings: An integrative analysis of the literature. Journal of Nursing Care Quality, 11(4): 60-72.

Reason, J. (2000). Human error: models and management. British Medical Journal, 320, 768-70.

Scott, W., Forrest, W., & Brown, B. (1976). Hospital structure and postoperative morality and morbidity. In S. Shortell & (Eds.), Organizational Research in Hospitals (pp.72-89). Chicago: Blue Cross Association.

Shortell, S., & Hughes, E. (1988). The effects of regulation, competition, and ownership on mortality rates among hospital inpatients. New England Journal of Medicine, 318(17), 1100-1107.

Shullanberger, G. (2000). Nurse staffing decisions: An integrative review of the literature. Nursing Economic$, 18(3), 124-136.

Silber, J., Rosenbaum, P., & Ross, R. (1995). Comparing the contributions of groups of predictors: Which outcomes vary with hospital rather than patient characteristics? Journal of the American Statistical Association, 90(429), 7-18.

Silber, J., Rosenbaum, P., Schwartz, J.S., Ross, R., Williams, S. (1995). JAMA, 274(4), 317-335.

Silber, J., Williams, S., Krakauer, H., & Schwartz, J. (1992). Hospital and patient characteristics associated with death after surgery: A study of adverse occurrence and failure to rescue. Medical Care, 30(7), 615-627.

Sochalski, J. and Aiken, L. (1999). Accounting for variation in hospital outcomes: A cross-national study. Health Affairs, 18(3), 256-259.

Table 1

DATA SOURCES FOR SELECT STUDIES

Study	**Unit of Analysis**	**Data Source(s) Staffing Data**	**Data Source(s) Patient Data**
Litchtig et al (1999)	Hospital	CA, NY Cost reports	Discharge abstract data (Uniform Hospital Discharge Data Set)
Kovner & Gergen (1998)	Hospital	AHA Annual Survey	HCUP-3 Nationwide Inpatient Sample
ANA (2000)	Hospital	HCFA's Provider of Service file Cost reports	State all-payer data sets MEDPAR
Needleman et al (2001)	Hospital	Cost reports Hospital staffing surveys	Discharge abstract data MEDPAR
Czaplinski & Diers (1998)	Unit	DRG as a proxy for nurse specialization	Hospital clinical information system (DRG, ICD-9, LOS, discharge dx, etc)
Blegen et al (1998)	Unit	Hospital HR systems	QA data from chart review Public relations data for compliant data Incident reports for falls & med errors
Flood & Diers (1988)	Unit	Patient classification staffing data	Discharge abstract data (UHDDS)

Table 2 **STUDIES IN PROGRESS**

Researcher(s)	Title/Description	Sponsor	Timeframe*
Blegen, Mary	Nurse Staffing and Quality of Care: To determine the relationship between nurse staffing patterns and quality of care in hospitals.	University of Colorado Health Sciences Center NINR: 5R01NR004937-02	Start: 7/1/2000 End: 6/30/02
Brewer, Barbara	Organizational Design and Patient Outcomes: Analyze failure to rescue, complication, mortality, falls, med errors in relationship to cost per case mix adjusted discharge.	University of Arizona NINR: 5F31NR07480-02	Start: 8/1/00 End:
Cho, Sung-Hyung	Nurse Staffing and Adverse Patient Outcomes: Examines the cost-benefits of increasing nurse staffing and nurse staffing-patient outcomes.	University of Michigan at Ann Arbor NINR: 1R03HS011397-01	Start: 4/1/01 End: 3/31/02
Johnson, Marion	Evaluation of Nursing Sensitive Patient Outcomes Measures: Validity and reliability testing of previously identified NOC. Analysis of the links between nursing diagnoses, interventions, and outcomes.	University of Iowa NINR: 5R01NR03437	Start: 5/1/98 End: 1/31/02
Mark, Barbara	Nursing Staffing, Financial Performance & Care Quality: Analysis of staffing, hospital financial performance, and quality (risk adjusted mortality, LOS, complications).	Virginia Commonwealth University (PI has moved to UNC at CH) NINR: 5R01HS10153-02	Start: 8/1/99 End: 1/31/02
Mark, Barbara	Model of Patient and Nursing Administration Outcomes: Analysis of hospital characteristics, unit characteristics, unit structure (decentralization, autonomy, physician collaboration, availability and responsiveness of support services), administrative outcomes (nurse satisfaction, turnover, team orientation, cost efficiency), and patient outcomes (med errors, falls, patient satisfaction). 146 medical/surgical units in southeast US and DC.	Virginia Commonwealth University (PI has moved to UNC at CH) NINR: 5R01NR03149-4	Start: 9/1/95 End: 6/30/01
Needleman, Jack	Nurse Staffing and Quality of Care: Describe changes in hospital nurse staffing over time and determine changes in the rates of adverse nurse sensitive events during the period. Explore the relationship between rates of ANSE and the level and mix of staff. Determine the relationship between changes in nursing level/mix and market pressure.	HSPH NINR: 5R01HS09958-02	Start: 7/1/99 End: 6/30/01
Sovie, Margaret	Hospital Restructuring's Impact on Outcomes: Examines the relationship between skill mix, total nursing care hours, and outcomes.	University of Pennsylvania NINR:	Start: 9/96 End: 3/2000 Study complete per communication 6/29/01. Awaiting govt release.

* It is reported that some studies listed are complete, but not yet made public.

Previously in this series

1. Consumer and Provider Views on Key Dimensions of Quality Hospital Care: A Review of the Literature	*April 1999*
2. States and the State of the Art for Health Care Quality Measurement and Reporting: An Environmental Scan	*September 1999*
3. Quality Hospital Care:What Does it Mean? The Results of Surveys and Focus Groups with Consumers and Health Providers in Rhode Island	*October 1999*
4. Reporting Publicly Accountable Performance Measures of Quality in Health Care: Review of Existing Databases in Rhode Island Focusing on the Hospital Setting	*May 2000*
5. Outcomes of Invasive Cardiac Procedures Rhode Island 1995–1997	*June 2000*
6. A Review of the Current State of Public Reporting on Health Care Quality Performance: States, Hospitals, and Coalitions	*July 2000*
7. Use of Administrative Data in Measuring of Quality Care	*August 2000*
8. A Profile of Medicare Beneficiaries in Rhode Island: Quality of Care Compared to New England States and the Nation	*May 2001*
9. Summary Report: Hospital Care Trends in Quality Indicators for Health Care in Rhode Island (1994-1998): Hospital Care, Access to Care and Utilization of Inpatient Procedures	*August 2001*
10. A Report of Patient Satisfaction with Hospital Care in Rhode Island	*Fall 2001*
11. Nursing Home Quality: A National Overview of Public Reporting Programs	*January 2002*

Rhode Island Series on Health Care Quality

Number 12